Amendments to the Claims:

1-29. (Cancelled)

30. (Currently amended) A method of bonding two structures together, the method comprising:

depositing low temperature grown semiconductor bonding layers on first and second structures by molecular beam epitaxy (MBE) at a temperature of at most about 100°C, wherein at least one of the bonding layers comprises an amorphous material;

placing the bonding layers in contact with each other to form a combined structure;

applying pressure to the combined structure; and

annealing the combined structure under conditions sufficient for the bonding layers to bond the first and second structures together,

wherein the annealing comprises crystallizing at least a portion of the amorphous material to a polycrystalline material.

31. (Original) The method of claim 30, further comprising applying the pressure substantially uniformly to the combined structure during annealing.

32. (Canceled)

33. (Currently amended) The method of claim 30, wherein the bonding layers comprise at least one of amorphous ~~(Ga,As)~~ gallium arsenide and polycrystalline ~~(Ga,As)~~gallium arsenide and the annealing of the combined structure occurs at a temperature of between about 300°C and 500°C and for a time sufficient for the bonding layers to form a ~~(Ga,As)~~gallium arsenide material that is substantially entirely polycrystalline.

34. (Currently amended) The method of claim 30, wherein the bonding layers comprise at least one of amorphous ~~(Ga,P)~~gallium phosphide and polycrystalline ~~(Ga,P)~~gallium phosphide and the annealing of the combined structure occurs at a

temperature of between about 500°C and 700°C and for a time sufficient for the bonding layers to form a ~~(Ga,P)~~gallium phosphide material that is substantially entirely polycrystalline.

35. (Currently amended) The method of claim 30, wherein the layers comprise at least one of amorphous ~~(Ga,N)~~gallium nitride and polycrystalline ~~(Ga,N)~~gallium nitride and the annealing of the combined structure occurs at a temperature of between about 700°C and 900°C and for a time sufficient for the bonding layers to form a ~~(Ga,N)~~gallium nitride material that is substantially entirely polycrystalline.

36. (Original) The method of claim 30, wherein the bonding layers are placed in contact with each other without regard for a relative angular orientation of the first and second structures to each other.

37. (Original) The method of claim 30, wherein at least one of the first and second structures comprises a non-semiconductor substrate.

38. (Original) The method of claim 30, further comprising fabricating at least one of an electronic and optoelectronic device from the combined structure.

39. (Previously presented) The method of claim 30, wherein the annealing of the combined structure occurs under conditions that are not damaging to the first and second structures but are sufficient to form bonds that are strong enough to survive subsequent processing at temperatures higher than those used during the bonding.

40. (Original) The method of claim 30, wherein a bonding interface produced by the annealing is substantially optically transparent to light emitted by the combined structure.

41. (Original) The method of claim 30, wherein a bonding interface produced by the annealing is strong enough to be substantially unaffected by processing of the combined structure.

42. (Original) The method of claim 30, wherein the deposition deposits between about 3 nm and about 600 nm of material on each of the first and second structures.

43. (Currently amended) The method of claim 30, wherein the deposition deposits at least one of low temperature grown ~~(Ga,As)~~gallium arsenide, ~~(Ga,P)~~ gallium phosphide and ~~(Ga,N)~~gallium nitride on at least one of the first and second structures.

44-45. (Cancelled)

46. (Previously presented) The method of claim 30, further comprising selecting a composition of the bonding layers such that a polycrystalline semiconductor layer is deposited on one of the first and second structures.

47. (Previously presented) The method of claim 46, wherein the annealing of the combined structure occurs under conditions sufficient for the polycrystalline semiconductor layer to recrystallize.

48. (Original) The method of claim 30, wherein the annealing occurs at temperatures of at most about 800°C.

49. (Previously presented) The method of claim 30, wherein the bonding layers comprise a compound semiconductor.

50. (Previously presented) The method of claim 49, further comprising doping the bonding layers with Si.

51. (Previously presented) The method of claim 49, further comprising doping the bonding layers with a dopant that helps to control morphology of the compound semiconductor.

52. (Previously presented) The method of claim 30, wherein the first and second structures are separate structures from each other before the bonding layers are placed in contact and the combined structure is annealed.

53-71. (Canceled)

72. (Withdrawn) The method of claim 30, wherein the bonding method is used in fabrication of a photodiode.

73. (Withdrawn) The method of claim 30, wherein the bonding method is used in fabrication of a transistor.

74. (Withdrawn) The method of claim 73, wherein the transistor is a heterojunction bipolar transistor.

75. (Withdrawn) The method of claim 73, wherein the transistor is a high-electron-mobility transistor.

76. (Withdrawn) The method of claim 30, wherein the bonding method is used in fabrication of a light-emitting diode.

77. (Withdrawn) The method of claim 30, wherein the bonding method is used in fabrication of a laser.

78. (Previously Presented) The method of claim 30, wherein at least one of the first and second structures comprises a semi-insulating substrate.

79. (Previously Presented) The method of claim 30, wherein at least one of the first and second structures comprises an insulator.

80. (Previously Presented) The method of claim 30, wherein at least one of the first and second structures comprises a pseudomorphic structure.

81. (Withdrawn) The method of claim 30, wherein at least one of the first and second structures comprises a multiple quantum well structure.

82. (Previously presented) The method of claim 30, wherein the bonding layers are devoid of polymers, ceramics, and metals.

83-101. (Canceled)

102. (Currently amended) A method of bonding two structures together, the method comprising:

depositing low temperature grown compound semiconductor bonding layers on separate first and second structures, wherein at least one of the bonding layers comprises one of gallium arsenide, gallium phosphide, and gallium nitride, and further wherein at least one of the bonding layers comprises an amorphous material;

placing the bonding layers of the separate first and second structures in contact with each other;

applying pressure to a combined structure of the first and second structures and the bonding layers; and

annealing the combined structure under conditions sufficient for the bonding layers to bond the first and second structures together,

wherein the annealing comprises crystallizing at least a portion of the amorphous material to a polycrystalline material.

103. (Previously presented) The method of claim 102, further comprising applying the pressure substantially uniformly to the combined structure during annealing.

104. (Canceled)

105. (Currently amended) The method of claim 102, wherein the bonding layers comprise[[s]] at least one of amorphous ~~(Ga,As)~~ gallium arsenide and polycrystalline ~~(Ga,As)~~gallium arsenide and the annealing of the combined structure occurs at a temperature of between about 300°C and 500°C and for a time sufficient for the bonding layers to form a ~~(Ga,As)~~gallium arsenide material that is substantially entirely polycrystalline.

106. (Currently amended) The method of claim 102, wherein the bonding layers comprise[[s]] at least one of amorphous ~~(Ga,P~~gallium phosphide~~)~~ and polycrystalline ~~(Ga,P)~~gallium phosphide and the annealing of the combined structure occurs at a temperature of between about 500°C and 700°C and for a time sufficient for the bonding

layers to form a ~~(Ga,P)~~ gallium phosphide material that is substantially entirely polycrystalline.

107. (Currently amended) The method of claim 102, wherein the bonding layers comprise[[s]] at least one of amorphous ~~(Ga,N)~~gallium nitride and polycrystalline ~~(Ga,N)~~gallium nitride and the annealing of the combined structure occurs at a temperature of between about 700°C and 900°C and for a time sufficient for the bonding layers to form a ~~(Ga,N)~~gallium nitride material that is substantially entirely polycrystalline.

108. (Previously presented) The method of claim 102, wherein at least one of the first and second structures comprises a non-semiconductor substrate.

109. (Previously presented) The method of claim 102, wherein the annealing of the combined structure occurs under conditions that are not damaging to the first and second structures but are sufficient to form bonds that are strong enough to survive subsequent processing at temperatures higher than that used during the bonding.

110. (Previously presented) The method of claim 102, wherein a bonding interface produced by the annealing is substantially optically transparent to light emitted by the combined structure.

111-113. (Cancelled)

114. (Previously presented) The method of claim 102, further comprising selecting a composition of the bonding layers such that a polycrystalline semiconductor layer is deposited on one of the first and second structures.

115. (Previously presented) The method of claim 114, wherein the annealing of the combined structure occurs under conditions sufficient for the polycrystalline semiconductor layer to recrystallize.

116. (Previously presented) The method of claim 102, wherein the annealing occurs at temperatures of at most about 800°C.

117. (Previously presented) The method of claim 102, further comprising doping the bonding layers.

118. (Previously presented) The method of claim 102, wherein the bonding layers are placed in contact with each other without regard for a relative angular orientation of the first and second structures to each other.

119. (Previously presented) The method of claim 102, wherein the bonding layers are deposited by molecular beam epitaxy (MBE) at a temperature of at most about 100°C.

120. (Previously presented) The method of claim 30, wherein the bonding layers on the first and second structures comprise a substantially identical material composition.

121. (Previously presented) The method of claim 30, wherein applying pressure to the combined structure comprises applying an external pressure to the combined structure.

122. (Previously presented) The method of claim 30, wherein both bonding layers comprise an amorphous material.

123. (Previously presented) The method of claim 30, wherein the annealing comprises crystallizing substantially all of the amorphous material to a polycrystalline material.

124. (Previously presented) The method of claim 30, wherein at least one of the bonding layers comprises a ternary or quaternary compound.

125. (Currently amended) The method of claim 124, wherein the ternary or quaternary compound is selected from the group consisting of ~~(In,Ga,As)~~indium gallium arsenide, ~~(In,Ga,P)~~indium gallium phosphide, and ~~(In,Ga,As,P)~~indium gallium arsenide phosphide.

126. (Previously presented) The method of claim 102, wherein the bonding layers on the first and second structures comprise a substantially identical material composition.

127. (Previously presented) The method of claim 102, wherein applying pressure to the combined structure comprises applying an external pressure to the combined structure.

128. (Previously presented) The method of claim 102, wherein both bonding layers comprise an amorphous material.

129. (Previously presented) The method of claim 102, wherein the annealing comprises crystallizing substantially all of the amorphous material to a polycrystalline material.

130. (Previously presented) The method of claim 102, wherein at least one of the bonding layers comprises a ternary or quaternary compound.

131. (Currently amended) The method of claim 130, wherein the ternary or quaternary compound is selected from the group consisting of ~~(In,Ga,As)~~indium gallium arsenide, ~~(In,Ga,P)~~indium gallium phosphide, and ~~(In,Ga,As,P)~~indium gallium arsenide phosphide.

132. (Currently amended) A method of bonding two structures together, the method comprising:

depositing low temperature grown semiconductor bonding layers on first and second structures, wherein at least one of the bonding layers comprises one of gallium arsenide, gallium phosphide, and gallium nitride, and further wherein at least one of the bonding layers comprises an amorphous material;

placing the bonding layers in contact with each other to form a combined structure;

applying pressure to the combined structure; and

crystallizing at least a portion of the amorphous material of the bonding layers to a polycrystalline material during the application of pressure to bond the first and second structures together.

133. (Previously presented) The method of claim 132, wherein crystallizing at least a portion of the amorphous material to a polycrystalline material comprises annealing the combined structure.

134. (Previously presented) The method of claim 133, wherein the annealing occurs for a time sufficient for crystallization of substantially all of the amorphous material to occur.

135. (Currently amended) The method of claim 132, wherein the bonding layers comprise at least one of amorphous ~~(Ga,As)~~ gallium arsenide and polycrystalline ~~(Ga,As)~~gallium arsenide and the crystallization occurs at an annealing temperature of between about 300°C and 500°C.

136. (Currently amended) The method of claim 132, wherein the bonding layers comprise at least one of amorphous ~~(Ga,P)~~gallium phosphide and polycrystalline ~~(Ga,P)~~gallium phosphide and the crystallization occurs at an annealing temperature of between about 500°C and 700°C.

137. (Currently amended) The method of claim 132, wherein the bonding layers comprise at least one of amorphous ~~(Ga,N)~~gallium nitride and polycrystalline ~~(Ga,N)~~gallium nitride and the crystallization occurs at an annealing temperature of between about 700°C and 900°C.

138. (Previously presented) The method of claim 132, wherein the crystallization of at least a portion of the amorphous material to a polycrystalline material occurs under conditions that are not damaging to the first and second structures but are sufficient to form bonds that are strong enough to survive subsequent processing at temperatures higher than those used during the bonding.

139. (Previously presented) The method of claim 132, wherein a bonding interface produced by the crystallization is substantially optically transparent to light emitted by the combined structure.

140. (Previously presented) The method of claim 132, wherein a bonding interface produced by the crystallization is strong enough to be substantially unaffected by processing of the combined structure.

141. (New) A method of bonding two structures together, the method comprising:

depositing low temperature grown semiconductor bonding layers on first and second structures, wherein at least one of the bonding layers comprises one of gallium arsenide, gallium phosphide, and gallium nitride, and further wherein at least one of the bonding layers comprises an amorphous material;

placing the bonding layers in contact with each other to form a combined structure;

applying pressure to the combined structure; and

annealing the combined structure under conditions sufficient for the bonding layers to bond the first and second structures together,

wherein the annealing comprises crystallizing at least a portion of the amorphous material to a polycrystalline material.

142. (New) A method of bonding two structures together, the method comprising:

depositing low temperature grown semiconductor bonding layers on first and second structures, wherein at least one of the bonding layers comprises an amorphous material;

doping the semiconductor bonding layers with Si;

placing the bonding layers in contact with each other to form a combined structure;

applying pressure to the combined structure; and

annealing the combined structure under conditions sufficient for the bonding layers to bond the first and second structures together,

wherein the annealing comprises crystallizing at least a portion of the amorphous material to a polycrystalline material.

143. (New) A method of bonding two structures together, the method comprising:

depositing low temperature grown semiconductor bonding layers on first and second structures, wherein at least one of the bonding layers comprises a ternary or quaternary compound, and further wherein at least one of the bonding layers comprises an amorphous material;

placing the bonding layers in contact with each other to form a combined structure;

applying pressure to the combined structure; and

annealing the combined structure under conditions sufficient for the bonding layers to bond the first and second structures together,

wherein the annealing comprises crystallizing at least a portion of the amorphous material to a polycrystalline material.

144. (New) A method of bonding two structures together, the method comprising:

depositing low temperature grown semiconductor bonding layers on first and second structures by molecular beam epitaxy (MBE) at a temperature of at most about 100°C, wherein at least one of the bonding layers comprises an amorphous material;

placing the bonding layers in contact with each other to form a combined structure;

applying pressure to the combined structure; and

crystallizing at least a portion of the amorphous material of the bonding layers to a polycrystalline material during the application of pressure to bond the first and second structures together.